RCS/RAP 84069

Buell, Thomas

From: Ex. 4 CBI
Sent: Thursday, November 18, 2021 10:47 AM
To: Buell, Thomas
Cc: Don Gunster; Wilhelm Welzenbach; Ex. 4 CBI Ex. 4 CBI Ex. 4 CBI
Subject: RE: AltEn treated water land application proposal - revised

Hi Tom,
As a follow-up, I wanted to offer an opportunity for a discussion on the soil sampling portion of the proposal, if it would be helpful for you and your team. Let us know.
Best,
Ex. 4 CBI

From: Buell, Thomas <thomas.buell@nebraska.gov>
Sent: Monday, November 15, 2021 7:24 AM
To: Ex. 4 CBI
Cc: Don Gunster <dgunster@newfields.com>; Wilhelm Welzenbach <wwelzenbach@newfields.com>; Ex. 4 CBI Ex. 4 CBI Overmyer, Jay Ex. 4 CBI Ex. 4 CBI
Subject: [EXTERNAL] RE: AltEn treated water land application proposal - revised

Thank you Ex. 4 CBI We will review the document and let you know if we have any questions.

Thanks,
Tom

Tom Buell
DIVISION ADMINISTRATOR, MONITORING AND REMEDIATION DIVISION

Nebraska Department of Environment and Energy
P.O. Box 98922
Lincoln, Nebraska 68509-8922

DIRECT: (402) 471-4270 / MAIN OFFICE (402) 471-2186

From: Ex. 4 CBI
Sent: Sunday, November 14, 2021 9:48 PM
To: Buell, Thomas <thomas.buell@nebraska.gov>
Cc: Don Gunster <dgunster@newfields.com>; Wilhelm Welzenbach <wwelzenbach@newfields.com>; Ex. 4 CBI
Ex. 4 CBI
Subject: AltEn treated water land application proposal - revised

Hi Tom,

20210738885

Hope you are doing well. Please find attached the updated land application proposal – we have addressed soil sampling comments (see pg 10-13), and made the requested edit to SOP 4, both documents are attached and updated. Please let me know if you have questions.

Best regards,

Ex. 4 CBI

Ex. 4 CBI

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SOP-4
TREATED WATER SAMPLING
ALTEN FACILITY, SAUNDERS COUNTY, NEBRASKA

Procedures are listed below for sampling treated water from the subject facility. Results of this testing will be used to determine appropriate land application rates of the treated water. Combined with volume monitoring data, treated water results will also be used to calculate mass of nutrients, salts, and pesticides added to soil by land application.

SAMPLING PROCEDURE

Temporary Tanks in 2021: Each tank is mixed continuously at approximately 1,000 gallons per minute, which is near the physical threshold for safe use of the tanks without creating a whirlpool-like circulation pattern. Field personnel collect a vertical composite sample of the circulating water from the safe sampling location on each tank (permanent access stairs). These stairs are on the northwestern part of Tank 1, southern part of Tank 2, and southwestern part of Tank 3. Before sampling, any reusable equipment that may contact lagoon water is decontaminated in accordance with SOP-1. The vertical composite sample is collected using a decontaminated 3/4-inch diameter, 10-feet-long polyethlylene water core sampler (Sludge Judge) to ensure coverage of the entire water column. From each tank, field personnel collect one unfiltered sample and one sample passed through a 0.5-micron filter, then repeat the sampling technique to provide sufficient volume for split analysis at a second laboratory.

Treated Water Ponds after 2021: Sampling procedure will be consistent with the description above, except circulation of the ponds will be driven by flow of incoming treated water, and there will be more accessible sampling locations to ensure lateral coverage of the ponds. To form the composite sample, 10-feet-long water core subsamples will be collected and placed in a bucket that has been decontaminated in accordance with SOP-1. The subsamples will be collected from the middle of each side of the pond. The composited volume will be transferred into laboratory-provided containers, with one unfiltered and one filtered set for each laboratory, per description above.

LABORATORY PARAMETERS

Treated water samples will be analyzed for the agronomic parameters listed below.

- Biological Oxygen Demand, 5-day
- pH
- Ammonia
- Total Kjeldahl Nitrogen
- Total Phosporus
- Nitrate/Nitrite
- Total Organic Carbon
- Total Suspended Solids
- Total Dissolved Solids
- Selenium
- Electrical Conductivity
- Sodium Adsorption Ratio

Treated water samples will be analyzed for the 53 pesticides listed in the summary statistics appendix provided with the land application proposal.

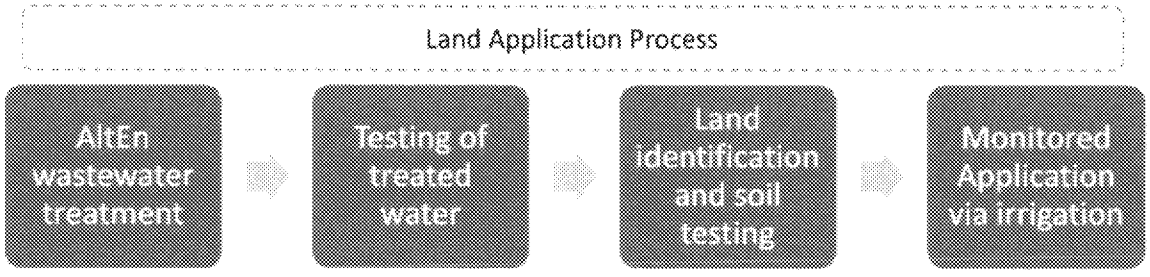
Proposed Approach for Management of Water from AltEn Site

Executive Summary:

A primary goal of current efforts at the AltEn site is to effectively manage water contained in the site's lagoons. The Facility Response Group's proposed plan to meet this goal is to filter the AltEn water and then land apply it at nearby agricultural fields. The plan utilizes a treatment process to significantly reduce pesticide residues and organic material present in AltEn water. The treated AltEn water is proposed to be used as agricultural irrigation water, similar to past practices in the area as well as throughout the state. The approach would place any trace pesticide residues into an agricultural system where the pesticide active ingredients are potentially already used or have registrations for comparable uses, and allow uptake of the nutrients present in the treated AltEn water by crops present.

The proposed thresholds for pesticides residues remaining in the water would be 10% or less of typical US EPA approved uses of the individual active ingredients that can be applied to a crop and would be consistent with those that can result from typical conventional farming practices. Application of the treated water would be intended to have no adverse consequences for crops, the soil, and the subsequent agricultural crop other than as a source of water and nutrients and would allow harvest and utilization of the crop as would normally occur. This approach is protective of the crop, agricultural lands, the environment, and people, as it accounts for approved uses and is based on US EPA scientific assessments of the safety of the individual active ingredients.

The figure below describes the high-level steps proposed as part of the interim action, with more detail included in the document's latter section.



Background on pesticides found at AltEn's site:

Each pesticide product undergoes thorough evaluation at the federal and state level prior to use, driven by the Federal Insecticide, Fungicide, and Rodenticide Act (FIFRA; a brief overview of FIRFA and pesticide registration is provided in Appendix A). Federal and state regulators conduct thorough evaluations of the environmental fate and degradation profiles, toxicology and ecotoxicology studies for each compound to determine uses and application rates that pose acceptable risk to humans and the environment. Regulatory data and decision documents were used as part of our analysis as we compiled the proposal herein.

We have reviewed treated water analytical data and the associated seed treatments used on seed by member companies in the relevant time period and have identified the active ingredients listed on Table 1 as the focus for the assessment. In addition, several pesticides which are not used as seed treatments (e.g., herbicides) have been detected in water at the AltEn site and will be considered for inclusion in the focused analyte panel.

The focused analyte panel is intended to be utilized for design of land application. We propose that land application compliance will be based on the focused analyte panel in treated water. The focused analyte panel targets analytes that present the greatest potential presence in treated water or implications for pesticide environmental loading in agricultural systems. Analytes that are part of the focused analyte panel are those that have been detected in treated water plus others that could be expected to be present. Factors that raise the expectation that an analyte could be present are:

- Consistent and high (i.e., greater than 75% frequency of detection and greater than 1000 parts per billion [ppb] average detection) levels of detection in baseline testing of untreated material on site.
- Analytes which are consistently present (greater than 75% frequency of detection) in baseline testing of treated water, particularly if near or above threshold levels proposed.
- Analytes which have increased persistence in the environment.
- In addition to the above considerations, we expanded the panel to include analytes which may have unique or specific considerations when used in agricultural systems, in an effort to be conservative and protective of human health and the environment. This may include:
    - Greater potential for risk to non-target organisms
    - Unique exposure reduction or handling requirements (e.g., greater than standard PPE, gloves, long sleeves/pants, closed footwear)
    - The analytes are also reflective of current seed treatment and seed treatment practices, and those probable to be present at the AltEn site (i.e., those analytes used within the past 5 years and representing more than 95% of the corn seed present on the AltEn site).

Data used to inform this final list are summarized in Appendix B.

Table 1: Overview of information and sample labels related to the active ingredients used as seed treatments on corn or identified at the AltEn site

Pesticide	Pesticide Group (e.g., FRAC, IRAC, HRAC)	Link to US EPA and IUPAC[a] review summaries	Detected at AltEn?	Registered use on corn?	*Sample Seed Treatment Uses*				*Sample Foliar/Other Uses*							*Sample Label Information*			Proposed threshold for single application (grams/acre)	Proposed threshold for total annual in-crop application (grams/acre)
					Example reference label	Example trade name	Corn use on label?	Single Application Seed Treatment (grams/acre)[b]	Example reference label	Example trade name	Corn use on label?	Chemigation use on label?	Other relevant uses on label (see Appendix C for crops relevant to Nebraska)	Max single application (grams/acre)	Max annual application (grams/acre)	Acceptable Crop Rotations after application	Grazing Restrictions	Re-entry interval following application		
Abamectin CAS number 71751-41-2	6-I	Abamectin EPA Summary	Yes	Yes	100-1399	Avicta Complete	Yes	5.5	100-1351	Agri-Mek SC	No	Yes	Soybean, Potato, Sweet Corn	8.6	17.3	Corn, Soybean, Cereals, Potato, Alfalfa	Do not graze treated crop	12 hours	1.1	2.2
Azoxystrobin CAS number 131860-33-8	11	Azoxystrobin EPA summary Azoxystrobin IUPAC summary	Yes	Yes	100-1399	Avicta Complete	Yes	0.1	100-1098	Quadris/Quilt	Yes	Yes	Soybean, Cereals, Potato, Alfalfa, Sweet Corn	113.4	908.0	Corn, Soybean, Cereals, Potato, Alfalfa	0 – 14 days after application on relevant crops	4 hours	11.30	22.6
Chlorantraniliprole CAS number 500008-45-7	28-I	Chlorantraniliprole EPA summary Chlorantraniliprole IUPAC summary	Yes	Yes	352-841	Lumivia	Yes	18.8	352-729	Coragen	Yes	Yes	Soybean, Cereals, Potato, Alfalfa, Sweet Corn	44.5	90.8	Corn, Soybean, Cereals, Alfalfa, Potato	14 days PHI, grazing not specifically defined	4 hours	4.45	8.9
Clothianidin CAS number 210880-92-5	4A-I	Clothianidin EPA summary Clothianidin IUPAC summary	Yes	Yes	7969-458	Poncho 600	Yes	12.5	59639-150	Belay	No	Yes	Soybeans, Potatoes	45.4	90.8	Corn, Soybean, Cereals, Potato, Alfalfa	Do not graze treated crop	12 hours	2.5	5.0
Fluoxastrobin CAS number 361377-29-9	11	Fluoxastrobin EPA summary Fluoxastrobin IUPAC summary	Yes	Yes	264-1169	Acceleron D-281	Yes	4.1	66330-64	Evito 480 SC	Yes	Yes	Soybeans, Potatoes, Wheat, Sweet Corn	81.7	163.4	Corn, Soybean, Cereals, Potato, Alfalfa	Up to 23 days after application (sweet corn)	12 hours	8.17	16.3
Imidacloprid CAS number 138261-41-3	4A	Imidacloprid EPA Summary Imidacloprid IUPAC Summary	Yes	Yes	264-968	Gaucho 600 Flowable	Yes	33.5	264-827	Admire Pro	No	Yes	Soybeans, Potatoes	21.2	227.0	Corn, Soybean, Cereals, Potato, Alfalfa	21 days PHI, grazing not specifically defined	12 hours	6.7	13.4
Glyphosate CAS number 1071-83-6	9-H	Glyphosate EPA Summary Glyphosate IUPAC summary	Yes	Yes	N/A	N/A	N/A	N/A	524-537	Roundup PowerMAX II	Yes	No	Soybeans, Alfalfa, Sweet Corn, Wheat	624.3	3308.5	Corn, Soybean, Cereals, Potato, Alfalfa	7 days after application	4 hours	62.43	124.9
Metalaxyl/Mefenoxam CAS numbers 57837-19-1 and 70630-17-0	4	Metalaxyl EPA Summary Metalaxyl IUPAC Summary Mefenoxam EPA Summary Mefenoxam IUPAC Summary	Yes	Yes	100-1399	Avicta Complete	Yes	0.1	100-1202	RidomilGold SL	No	Yes	Soybean, Potato, Alfalfa	283.8	283.8	Corn, Soybean, Cereals, Potato, Alfalfa	60 days after application (alfalfa)	48 hours	14.2[c]	28.4
Prothioconazole CAS number 178928-70-6	3	Prothioconazole EPA summary Prothioconazole IUPAC summary	Yes	Yes	264-825	Proline480 SC	Yes	8.1	264-1093	Stratego YLD	Yes	Yes	Soybean, Wheat, Potato, Sweet Corn	18.6	37.2	Corn, Soybean, Cereals, Potato, Alfalfa	No restriction for corn, 30 days for barley/ wheat	12 hours	1.86	3.7
Sedaxane[d] CAS number 874967-67-6	7	Sedaxane EPA Summary Sedaxane IUPAC Summary	Not on original panel	Yes	100-1374	Vibrance	Yes	2.5	N/A	N/A	N/A	N/A	No foliar crops	0.0	12.0	Corn, Soybean, Cereals, Potato,	No restrictions on ST label	12 hours	0.51	1.0

																Alfalfa (based on ST)				
Tebuconazole CAS number 107534-96-3	3	Tebuconazole EPA summary Tebuconazole IUPAC summary	Yes	Yes	42750-130	TebuStar 250 ST	Yes	1.0	264-849	Absolute MAXX	Yes	Yes	Wheat, Sweet Corn	46.4	92.8	Corn, Soybean, Wheat, Alfalfa, Potato	30 days (wheat)	12 hours	4.64	9.3
Thiabendazole CAS number 148-79-8	3	Thiabendazole EPA summary Thiabendazole IUPAC summary	Yes	Yes	100-1399	Avicta Complete	Yes	1.3	N/A	N/A	N/A	N/A	Post-harvest uses on carrot, citrus, potato, pome fruit, and ornamental bulbs and corn[e]	0.0	68.0	Corn, Soybean, Cereals, Potato, Alfalfa	No Restriction	12 hours	0.26	0.52
Thiamethoxam CAS number 153719-23-4	4A-I	Thiamethoxam EPA summary Thiamethoxam IUPAC summary	Yes	Yes	100-1399	Avicta Complete	Yes	12.5	100-938	Actara	No	Yes	Potatoes	28.4	56.8	Corn, Wheat, Potato, Soybeans, Alfalfa	No grazing of cover crops	12 hours	2.5	5.0

[a] IUPAC summary reference: Lewis, K.A., Tzilivakis, J., Warner, D. and Green, A. (2016) An international database for pesticide risk assessments and management. Human and Ecological Risk Assessment: An International Journal, 22(4), 1050-1064. DOI: 10.1080/10807039.2015.1133242

[b] Based on 25,000 seeds planted per acre, and 1680 corn seed per pound, following recent US EPA seed treatment product risk assessments.

[c] Single application limit set based on 5% of foliar rate vs 20% seed treatment rate due to very wide variance between foliar application rates and seed treatment rates for Metalaxyl/mefenoxam

[d] Within the Ex. 4 CBI portfolio, multiple SDHI pesticides have been developed that offer complementary benefits and disease control. Although the safety profile for sedaxane could support foliar uses, this active ingredient was determined to be better positioned as a seed treatment. In addition, while plans to test for sedaxane in the analyte panel are being developed, finding analytical labs with this testing capability has proven difficult.

[e] When thiabendazole was registered by Merck, there were foliar applications on the label (e.g., sugar beet, soybean, wheat, rice, and dry beans). After the acquisition of Merck, Novartis (then Ex. 4 CBI had developed and were developing many new and highly effective fungicides (strobilurins, triazoles, SDHIs) that were better suited than thiabendazole for foliar uses. Although the safety profile for thiabendazole could support foliar uses, since 1998, the thiabendazole uses have been focused on the seed treatment and post-harvest markets.

Explanatory description of Table 1:

Table 1 provides an overview of sample labels for pesticide active ingredients that are on the focused analyte panel. This table is intended to provide examples of characteristics or considerations from the sample labels associated with formulated products which have undergone rigorous regulatory scientific reviews by U.S. EPA. Information included such as maximum use rates, or restriction from product labels are specifically for the products' use as a pesticide at the labeled rate and following label instructions and mitigations as applicable. Labeled rates reflect the amount of product a pesticide applicator would apply for the purposes of managing pests or disease on a farmer's field or a homeowner's lawn and which are many times higher than the trace amounts that may be present following treatment of the water at the AltEn site. The overview table is intended to provide context for land application guidance of treated lagoon water, which may have unique mixtures of trace levels of pesticides, but not restricted by them as the land application is not a labelled pesticide application. We propose the following mitigations following treated water application which consider representative pesticide labels and are protective of human health and the environment:

1. Re-entry interval following treated water application – 12 hours
2. Grazing restrictions – no grazing for 14 days on land that has received treated water; follow applicable label restrictions if in-season pesticide applications are made
3. Acceptable crop rotations – corn, wheat, potato, soybeans, alfalfa

Background on AltEn site: Water utilized in AltEn ethanol production processes and surface storm water is currently held in storage lagoons and tanks on the AltEn site. This water contains trace levels of pesticide residues derived from treated seed used in AltEn's ethanol production. In addition, there are some herbicide residues in the water, potentially as a result of vegetation control around the water storage lagoons. The water also contains high nutrient levels due to the presence of manure at the AltEn site. The addition of expired beverages (alcohol and soda) and industrial/food grade starch have unknown contribution to the byproduct material or residues present.

The total untreated water volume currently held on the AltEn site (three primary lined lagoons and the emergency lagoon) exceeds 150 million gallons. The water has accumulated over multiple years of AltEn operations; additional water has been added from on-site storm water collection and recent equipment cleaning by AltEn. Additionally, the leakage of up to 4 million gallons of thin stillage/manure from a digester unit in the late winter of 2021 and the subsequent collection of this water and affected ice have added to the volume held on site.

Although there is likely some ongoing natural degradation of the pesticide components in the stored lagoon water from exposure to sunlight (photolysis), microbial activity (biodegradation), and interaction with water (hydrolysis), these processes are not sufficient to clear the water of the components in a reasonable timeframe. Filtration units have been used to assist in the removal of the pesticides and organic material. Initial site stabilization efforts have treated a substantial volume of water to date, which is currently held in temporary tanks pending construction of a pond for winter storage. The water treatment units have been highly effective in removing pesticides.

Historically, AltEn obtained permits from NDEE to enable the discharge of water from the plant operation. The historical permit and best management plans provide insight on previous permit requirements.

The following is a proposal for the disposition of the treated water to facilitate lagoon stabilization in advance of further site response activities.

Proposed Disposition of Treated Water:

Use as irrigation water is currently the only known disposition for treated water from the AltEn lagoons containing nutrients and potentially trace pesticide residues. Treated irrigation water would be applied by irrigation systems to field corn production, fallow, or post-harvest fields on land in relative proximity to the AltEn site, using an existing irrigation water distribution system or temporary transfer piping. The utilization of the treated water in these situations would allow uptake of the nutrients present in the water by the corn or other vegetation, while placing any pesticide residues into an agricultural system where the pesticide active ingredients have registrations for comparable uses. The proposed application of the treated water would be intended to have no consequences for the corn crop other than as a source of water and nutrients and would allow harvest and utilization of the crop as would normally occur.

Based on treated water testing for pesticide active ingredients, as well as evaluation of approved uses, any pesticide residue introduced to the agricultural system through land application of treated water would be consistent with application rates that can result from typical current farming practices utilizing labelled pesticide applications. Specifically, concentrations of the focused analyte panel in treated water

samples collected in accordance with SOP-4 (Standard Operating Procedures; Appendix E) will be multiplied by the volume of water applied and divided by the area receiving the water to determine grams per acre of active ingredient. Design to ensure Table 1 thresholds are not exceeded will be performed prior to application, and verification of volumes and grams per acre applied will be performed at least monthly. These evaluations will be performed on a field-by-field basis.

Analyte Target Filtration Level: Raw water held in the AltEn storage lagoons will be treated on-site to remove pesticide residues to the lowest practical levels (based on analyte-specific detection limits) for pesticides identified in Table 1. The Facility Response Group will sample treated water to support land application as described above. Lagoon sampling may be performed for other purposes, but no future sampling of untreated lagoons is proposed to support land application.

- **Focused Analyte List** - The list of analytes for design of land application is primarily based on those present in treated water, and the seed treatment active ingredients identified as being applied to seed delivered to AltEn by feedstock suppliers. Other pesticides identified in initial screening analytical suites utilized to assess material connected to the AltEn site were also considered. Analytes were grouped into families or modes of action to consider cumulative environmental impacts. Degradants or metabolites of concern for a pesticide compound, as determined by US EPA, were considered during development of the analytical suite. The focused analyte list is focused on key analytes identified as having high initial levels of detection in on-site material, increased potential for presence in treated water or greater implications for pesticide environmental loading/impact/persistence in agricultural systems. The utilization of a focused analyte suite enables more efficient testing processes while assessing analytes that have the greatest potential to be present or have a potential impact in the environment. Level of detection for each analyte listed in Table 1 will be communicated to NDEE and will be based on the validated relevant analytical methods and associated detection and quantification limits relevant for the filtered/treated water and threshold context. Total pesticide concentration is defined as dissolved plus sorbed pesticide residues from treated water.

- **Analyte Thresholds** - For each chemical in the focused analyte list, a proposed threshold level was determined to allow use as irrigation water in field corn production or application to post harvest agricultural land. To be further protective of human health and the environment, threshold targets are proposed for each active ingredient that are a fraction of the US EPA-approved application rates for the pesticides and reflect a margin of safety of at least 10X based on US EPA scientific reviews. The threshold targets for an active ingredient will be proposed for a single irrigation application and cumulative total amounts for a crop production cycle. Single irrigation application thresholds will be based on US EPA-approved application rates for corn that represent 10% of foliar rates (20% of seed treatment rates if no foliar rate for corn is established for the active ingredient). Individual active ingredient thresholds may be set at higher rates than guidance above where the maximum allowable annual usage is significantly higher than 10% of foliar rate or 20% of the seed treatment rate, as is the case with metalaxyl. However, the higher rates will not exceed 50% of the foliar rate. Additionally, the combined total of a family grouping (mode of action) will not exceed 200% of the cumulative thresholds. For example, if a family grouping has 3 active ingredients and 2 are detected at their established thresholds, the third active ingredient could not be detected (e.g., 100% + 100% + 0% = 200%).

This approach will ensure that cumulative applications of active ingredients belonging to a family grouping will remain below levels that are protective of human health and the environment. A second threshold will be set for the total active ingredient that can be applied in irrigation water in a crop production cycle and will be based on 2X the single application threshold. Appendix D describes an example lookup table for allowable pesticide active ingredient concentrations per application of each acre-inch of water (102,736 liters). Thresholds for degradates or metabolites for a pesticide identified as potentially presenting increased risk are included in the analytical suite and do not exceed the threshold for the pesticide from which it was derived. Ensuring that application rates of focused analytes in treated water are a fraction of US EPA approved application rates provides assurance that this proposal is protective of human health and the environment.

- **Threshold Equivalence** - The comparison to US EPA registered labels is intended to assess existing application methodology, rates, or use patterns to ensure the proposed irrigation application of treated water is within the scope of scientific assessments conducted as part of US EPA reviews for registration for agricultural use. The comparison to US EPA registered labels is not intended to suggest applications would be for any pest control purposes as any residues remaining in the treated water would not reflect a specific registered product or provide such benefit. The equivalence-based method will ensure that where analytes are present at very low levels, they have already been assessed for safety and environmental impact in corn production or presence in agricultural environments. The proposed threshold rates were derived to ensure that any remaining residues in water do not represent a significant addition to the environmental loading or potential crop residues allowed through approved corn pesticide use. The proposed thresholds for individual analytes are intended to accommodate variability in filtration system processes, inconsistent residue levels in untreated water, analytical variability, and to enable expedited reduction in the overall pesticide residues present at the AltEn site while minimizing environmental risks through use of the treated water in an agricultural system where the pesticides would already potentially be present from approved uses.

Nutrient and Water Quality Target Level: Raw water held in the AltEn storage lagoons will be treated on site to remove organic and other materials (in solid or flocculated form) resulting in some reduction in total nutrient composition. The filtration process is not expected to remove all nutrients or affect general water quality parameters that need to be considered in establishing land application guidelines. To address these aspects and to ensure adequate soil and surface water protection (as specified by NDEE) for non-pesticide components in the treated water, the analytical suite will also include the following parameters:

BOD5 (parts per million, ppm)	Nitrite (ppm)	Total Kjedahl Nitrogen (TKN)
Nitrates (ppm)	Phosphorus	Total Organic Carbon (TOC)
Ammonia (ppm)	Selenium	Total Suspended Solids (TSS)
pH	Sodium Adsorption Ratio (SAR) and Electrical Conductivity (EC)	Total Dissolved Solids (TDS)

Treated water application rates will be developed in consultation with crop nutrient and irrigation experts (certified agronomists) to ensure individual land applications are made in consideration of land/soil type, existing nutrient/soil profiles, crop production practice, irrigation systems and any other factors that may be deemed critical to minimize environment or crop impacts and meet Nebraska irrigation water requirements.

Field Irrigation Requirements: Fields identified to receive treated water applications from the AltEn site will be assessed for suitability for water holding and nutrient management as per the revised AltEn, LLC - Best Management Practices Plan prepared in draft form by Nutrient Advisors of West Point, NE. The Facility Response Group is negotiating with landowners in the vicinity of AltEn lagoons and will update the Best Management Practices (BMP) Plan when landowners have completed participation agreements. The extent of land being considered for potential outreach and negotiations is within three miles of the center of the AltEn lagoons (Figure 1), as more-distant fields would be cost prohibitive for the large volume of water.

The BMP Plan focuses on nutrient requirements and avoiding sodium impacts, while staying within the maximum annual applied grams per acre for each analyte listed in Table 1. The table reflects labeled uses and summarizes plant back restrictions. The BMP Plan will be finalized and implemented by professional agronomists in collaboration with the landowners. Any cover crops for the post-harvest land application period will have low attractiveness rating to pollinators.

During land application, the Facility Response Group will work with agronomists and crop advisors to monitor the rate of land application (acre inches per management unit), moisture status of the soil, and crop response. Rates of land application will depend on the infiltration and percolation rate, weather, nutrient demands and sodium loading limits, and will not exceed the annual pesticide loading rates listed in Table 1. Implementation of the BMP Plan will include appropriate record keeping and annual reporting to applicable agencies.

Land suitable for application of treated water by irrigation

- **Agricultural land in annual crop production:** This would include any land currently producing an annual crop which is actively growing, utilizing water and nutrients. Field corn is the preferred crop for application of the treated water due to a large percentage of acreage in the area and the high utilization rate of water and nutrients. In addition, pesticide residues which may potentially be present in the treated water are primarily derived from corn seed treatment uses, therefore are already assessed for use in this crop. The application of the treated water in field corn production will efficiently allow nutrients present in the water to be utilized by the corn, extracting a valuable resource, while limiting the potential for movement off-field and will place any trace pesticide residues into an agricultural system where the products are already present or potentially used. The proposed application of the treated water would be intended to have no consequences for the corn crop in production other than as a source of water and nutrients and would allow harvest and utilization of the crop as would normally occur. Any pesticide residue introduced to the agricultural system on the land would be consistent with those that

occur in typical current farm practices utilizing labelled pesticide applications. Typical timing of pest management is at planting via treated seed, early season application for weed management or insect pest management, and later season for disease or insect management as needed and based on agronomics of the crop. Trace levels of pesticides that may be present in the treated water would be a fraction of a labeled application rate and will not provide any pest control value nor effect planned rotational crops (see Table 1 for crop rotation information). Other annual crops could be utilized for irrigation for the treated water once adjusted for the typically lower nutrient utilization and assessment for labelled use of pesticides detected in the treated water.

- **Agricultural land in post-harvest status from annual crop production:** This category includes any land where an annual crop has been harvested and the land is being prepared for the next planting of a crop. The application of treated water to the land would be intended to prepare the next crop with soil moisture and nutrients. Applications rates of treated water would be determined by the water holding capacity of the soil and nutrient needs of the planned crop. The preferred crop for planned planting should be consistent with those typically following field corn (see Table 1 for crop rotation information), as any trace pesticide residue present in the treated water would be a fraction of labeled rate typically used in conventional annual field corn crop agricultural systems and would present no consequences for a typical rotational planted crop or to human health and the environment. Overall, the trace levels of pesticide residues potentially present in treated water would be a fraction of labelled rates typically used in agricultural systems and the cumulative contribution to pesticide residues present in a typical field would not have any impact on human health or the environment.
- Land considered for application falls within Lower Platte North Natural Resource District (NRD). Soil conditions, mapped setbacks for surface water and other features, and crop nutrient demands will be described in the final BMP Plan when landowner participation agreements are finalized. Timing for application will align to NRD requirements, balancing factors such as benefits of cover crops, soil temperature, and general weather (i.e., freezing temperatures).

The following are proposed requirements for target application fields to receive treated water from the AltEn site:

- **Land Management and Selection –** The pesticidal active ingredients found in the wastewater at AltEn have been registered for use in the US and on crops in the state of Nebraska since the early 2000s. These products have been used in Nebraska since that time, and therefore may be present at low levels in soil and surface water. Land selection and management must ensure:
    a. Areas that may be prone to overland water movement have tillage, berms, or other features to prevent any excess irrigation water from flowing off the application area. In no instance shall slopes exceed 12 degrees.
        - For fields that have tile drainage systems installed, the irrigation applications rates must ensure water holding capacity is not exceeded during irrigation which may allow drainage from the tile system. Treated water will not be applied to fields with tile drains that do not have an actively growing crop or cover crops, unless other protections are present.
    a. Fields must not have seasonal or permanent bodies of water located within the treated water application area.

b. Fields must have an analysis of soil quality, texture and structure for assessment of water holding capacity and potential for leaching and impacts of any water quality aspects (e.g., salt) of the treated water. Standardized multi-aliquot, composite soil sampling protocols will be followed to account for variability across a field.
c. Fields will have analysis of nutrient levels post-harvest to facilitate nutrient loading assessment and planning. Soil sampling procedures to determine nutrient and salt content are described in SOP-2 (Appendix E). The Facility Response Group will comply with the Lower Platte North NRD requirements for nutrient management, and may repeat soil nutrient sampling in spring to verify nutrients were retained over winter, if requested by NDEE on a field-by-field basis.
d. Land owners/managers will be required to disclose if the land being considered for selection has previously had water or wetcake from the AltEn site applied.
e. Soil samples will be collected from fields proposed for land application, and the samples will be analyzed for pesticide residues in candidate fields. Soil sampling procedures to determine pesticide content are described in SOP-3 (Appendix E). Soil pesticide analysis limitations and proposed use of soil data are presented below.

Limitations of Testing for Soil Pesticide Residues

The land in typical conventional agricultural systems would be expected to have detections of pesticide residues, but detections of specific pesticides and levels are anticipated to be variable and dependent on a number of factors.

Different conditions or practices in the field can influence potential pesticide soil residues and have a significant impact on the variability of individual sample test results. These factors include, but are not limited to:

- Temporal and spatial variability in the levels of a pesticide applied to individual fields based on management practices.
- The extraction efficiencies and matrix interferences can be very complex for soil, contributing to an increased level of variability in pesticide detections in soil.
    - Testing methods for treated water are less complex and prospective sources of variability (i.e., extraction efficiencies, matrix interferences) are far fewer than those required for soil matrices, reducing variability and increasing the precision and accuracy of results.
- Management practices implemented by the grower that influence degradation of pesticides present, which can include tillage practices, crop rotational practices, soil amendments, irrigation practices.
- Pest management practices during crop production that will introduce pesticides to the agricultural environment present in the soil. The type, rate and timing of the pesticide application will all have an influence on levels potentially detected in soil residue testing at a given time. For example, pest management practices that occurred at higher rates and/or just prior to sampling would be anticipated to result in higher detection levels compared to sampling conducted weeks or months after the application. Additionally, if a grower tends to utilize a specific pest control product more frequently, this could contribute to higher detection levels compared to other products. As pest management

practices can occur at various points in the crop protection season, residue levels will vary accordingly over the year as pesticides are introduced and degradation occurs.
- Each pesticide product will have different degradation timeframes and environmental fates which can be influenced by the soil types and environmental factors.
- Environmental conditions present in the field during the year will influence the rate of residue degradation. This can include variables like amount of rainfall, temperature, micro-biome, and ground cover present.
- Soil types will vary significantly from field to field and within a field. The soil types present can influence the rate of residue degradation, adsorption/desorption and detection[1].
- Organic matter typically controls the degree that pesticides adsorb to soil[2]. Organic matter is highly variable laterally and vertically[3] as well as seasonally[4] in a field. Soil testing for pesticides tends to document organic matter variability and related pesticide sorption, rather than accurately measure pesticide

Concentrations of pesticide residues in soil are a function of the application rate, soil type, microbial activity, weather, and the physiochemical properties of the pesticide. In general, soil pesticide levels will increase following applications and decline over time. If a pesticide is used every growing season, it may be present at detectable levels in subsequent seasons. For example, a 2015 study with clothianidin demonstrated that soil levels of this pesticide reach a plateau after several years of use. Additionally, clothianidin became less bioavailable over time, meaning it was sorbed to the soil and not available for plant uptake[5].

Proposed Use of Soil Data

Pesticide results for soil samples collected in accordance with SOP-3 (Appendix E) will be inspected as an application screen for participating fields. For each new proposed field, the Facility Response Group will evaluate results for each chemical in the focused analyte panel by comparing box-and-whisker plots for the new field to such plots for data from all previously reviewed fields, and visually inspecting for consistency. Should visual inspection indicate a distribution of any focused analyte that is higher than for previously-reviewed fields, statistical

[1] U.S. EPA. Undated. Technical Overview of Ecological Risk Assessment. Analysis Phase: Exposure Characterization. https://www.epa.gov/pesticide-science-and-assessing-pesticide-risks/technical-overview-ecological-risk-assessment-1 [Accessed September 27, 2021]

[2] U.S. Department of Agriculture – Natural Resources Conservation Service, January 1998. Soil Quality Concerns: Pesticides. https://www.nrcs.usda.gov/Internet/FSE_DOCUMENTS/nrcs142p2_052821.pdf [Accessed September 27, 2021]

[3] VandenBygaart, A.J. et al. 2007. Assessment of the lateral and vertical variability of soil organic carbon. Canadian Journal of Soil Science. https://cdnsciencepub.com/doi/pdf/10.4141/CJSS06025

[4] Wuest, S. 2014. Seasonal Variation in Soil Organic Carbon. Soil Science Society of America Journal. https://www.ars.usda.gov/ARSUserFiles/6233/seasonalVariationInSoilOrganic.pdf

[5] Xu, T. et al. 2015. Clothianidin in agricultural soils and uptake into corn pollen and canola nectar after multiyear seed treatment applications. Environmental Toxicology and Chemistry. https://setac.onlinelibrary.wiley.com/doi/10.1002/etc.3281

techniques will be used to confirm or deny the apparent difference. Statistical technique will be t-test or Mann-Whitney u test. Should this type of evaluation be necessary, the Facility Response Group will propose statistical acceptance criteria to NDEE. Fields that do not have apparent higher concentrations of any of chemicals from the focused analyte panel will be admitted into the land application program.

- **Treated Water Testing** - Treated water will be tested by an accredited laboratory for the 53 pesticides listed in Appendix B. Testing will also include nutrient and water quality parameters. Results from this testing will be utilized to determine volumes of treated water that can be applied without exceeding agronomic rates (for example calculations based on analytes, refer to Appendix D). Tests shall be completed for each contained storage unit of treated water (~3,000,000 gallons). Each tank is mixed continuously at approximately 1,000 gallons per minute, which is near the physical threshold for safe use of the tanks without creating a whirlpool-like circulation pattern. Field personnel collect a vertical composite sample of the circulating, mixed water from the one safe sampling location on each tank, which is at the permanent access stairs. These stairs are on the northwestern part of Tank 1, the southern part of Tank 2, and the southwestern part of Tank 3. The vertical composite sample is collected using a clean decontaminated 3/4-inch diameter, 10-feet-long polyethylene water core sampler (commonly referred to as a Sludge Judge) to ensure coverage of the entire water column in the circulated tank. From each location, field personnel collected one unfiltered sample and one sample passed through a 0.5-micron filter, then repeated the sampling technique to provide sufficient volume for split analysis at a second laboratory. The response group proposes to use data from samples collected August 5, 2021 to support land application in 2021. Additional composite sampling would be performed from the proposed treated water pond to support land application in 2022.
- **Irrigation Systems** - Treated water from the AltEn site will be contained during delivery to the target field based on the following requirements:
    a. If applicable, delivery systems will have control systems to prevent backflow into municipal/public water systems or ground water.
    b. If the delivery pipeline has branch lines, these will be isolated by control valves that have locks or access controls that prevent the valves from being changed.
    c. Irrigation water delivery systems will be monitored for leaks during any irrigation with treated water.
- **Crop Production –** Treated water from the AltEn site will be applied only to fields that have been assessed to ensure the active ingredient residues detected will not impact existing crops/vegetation cover or existing biodiversity (non-cultivated areas). Preferred options are field corn due to high water/nutrient utilization and corn seed being the primary source of pesticide residues, or post-harvest fields in preparation for annual crop production. To be protective of human health and the environment, all fields will be assessed against the following requirements:
    a. Crops or plants in production/growing should have traits that provide tolerance to glyphosate and glufosinate.
    b. Annual crops can have standard seed treatment packages, but may not have high-rate application (e.g., corn @ 1250 rate) of neonicotinoid seed treatments.

c. Applications of fungicide or insecticides will be documented and reported to ensure these are factored into overall pesticide load within the field. In fields that do not have a crop present during water application, analytical data for the applied water will be used to inform management decisions for future crops to ensure protection of human health and the environment.
d. Fertilizer applications (i.e., applications prior to or during planting, or prior to field soil testing conducted in advance of application of the treated water) will be disclosed and factored into the nutrient loading that will result from application of treated water. Total nutrient loading or individual applications during the growing season must not exceed agronomic and Nebraska defined requirements.
e. Flowering weeds in treated water application area must be controlled to prevent flowering prior to and during the growing season.
f. No honey bee hives or other managed pollinators should be located in immediate proximity (closer than 200 feet) of the field irrigated with treated water.
g. No applications of treated water should occur within 30 days prior to harvest.
h. Growers will follow all state environmental protection standards applicable to crop production.
i. Contracts will be in place with each grower outlining any applicable requirements and provide a transparent disclosure of the treated water quality.
j. When post-harvest land in annual crop production is receiving treated water, fall cover crops may be planted. Cover crops must not include flowering plants which could attract pollinators. However, it is important to note that pollinator activity is reduced in October and after a hard frost will be negligible due to a lack of viable flowering plants in the landscape, therefore it is unlikely pollinators will be present in post-harvest or cover crop situations. In addition, the trace levels of pesticides which might be present in treated water will not be translocated into plant tissue at levels that would result in potential risk to pollinators that might be present.

* **Irrigation Management** – Treated water may not be applied in volumes exceeding the soil water holding capacity and safeguards must be in place to prevent applied water from moving off the production field. Water applications will consider crop growth stage, previous precipitation, and agronomic conditions, based on expert advice from certified crop advisors.
    a. No individual application of treated water can exceed 1 inch during a 1-week period. This will equate to approximately 27,143 gallons of treated water applied per acre irrigated.
    b. A maximum application of up to 2 inches of treated water can be made during the crop production season. This will equate to approximately 54,286 gallons of treated water applied per acre irrigated. Additional treated water can be applied post-harvest, but cannot exceed soil water holding capacities or professional agronomist recommended nutrient levels.
    c. Planned irrigation applications must consider rain events to prevent exceeding the soil water holding capacity and leading to potential surface runoff or ponding.
    d. Water application should be at volumes/rates that allow for rapid infiltration and prevent the potential for ponding in the field. If ponding is observed, application in that

area of the field would cease and rates of application adjusted to prevent ponding in adjacent areas.

e. End guns and/or sprinklers must not allow treated water to be applied outside the boundaries of the field or areas not planted for field corn production.
f. Treated water application areas require the following setbacks:
    i. 30-foot vegetative buffer strip to any public right-of-way;
    ii. 300-foot separation from inhabited dwelling;
    iii. 300-foot separation from potable water supply well;
    iv. 1000-foot separation from a community public water supply;
    v. 200-foot separation from waters of the State.
g. Application of treated water may occur for field corn, or post-harvest as applicable, based on advice from certified crop advisors. Application timing will be determined by nutrient levels.

US EPA considers numerous factors impacting a pesticide's environmental fate, including those listed above, in order to ensure approved uses are protective of human health and the environment.

Deviations from BMP for Management of Water from AltEn Site

Deviations from the best management practices for management of water from AltEn site will be reported to the applicable agencies, as required. Although not expected, should actual application rates exceed designed treated water application rates, sampling of the crop will potentially be required to determine compliance with U.S. EPA approved tolerances (e.g., Appendix F).

Summary: The proposed land application is intended to be equivalent and consistent with existing agricultural system practices for land in field corn production in the Midwest. The proposed plan is protective of human health and the environment, and would create minimal disruption in normal agricultural practices. The proposed application of treated water is not expected to cause changes in the plant-soil health characteristics or degrade the long-term use of the application area. The primary goal of current efforts at the AltEn site is to effectively manage water (primarily from the site's lagoons), and the proposed plan herein is a critical step toward achieving that goal. This approach is protective of the crop, agricultural lands, the environment, and people, as it accounts for approved uses and is based on US EPA scientific assessments of the safety of the active ingredients.

Appendix A – Background on pesticide and treated seed regulation in the US

The Federal Insecticide, Fungicide and Rodenticide Act (FIFRA) requires registration of pesticides with US EPA. Under FIFRA, a pesticide cannot "cause unreasonable adverse effects on the environment," which is defined as "any unreasonable risk to man or the environment taking into account economic, social and environmental costs and benefits of the use of any pesticide."

Criteria for pesticide registration include:

- the chemical's composition to warrant the proposed claims for it;
- the chemical's labeling and other material required to be submitted to comply with requirements of the act;
- when used in accordance with widespread and commonly recognized practice, it will not generally cause unreasonable effects on the environment.

Manufacturers must provide test data to the US EPA upon which registration is based, following testing guidelines, which US EPA publishes specifying the kinds of data needed.

Seed treatment products are highly regulated under FIFRA, as are sprayed and soil-applied pesticides. They undergo thorough evaluation by the US EPA, and applicable state agencies, prior to commercialization and periodically thereafter. Only after a seed treatment product is approved by the relevant federal and state agencies, can the product be used per the conditions set by US EPA.

US EPA assesses any potential risks for use of seed treatment products from applying the product and planting the seed (i.e., environmental fate, ecotoxicology, and operator exposures) to the consumption of the harvested commodity by the consumer. US EPA's associated science-based evaluation also considers the application rates, analysis of the quantity "planted per day", typical seeding/planting rates per acre, etc. All pesticides are subject to review every 15 years to ensure that, as the science advances and/or policies and pesticide use practices change over time, all registered products continue to meet the statutory standard of "no unreasonable adverse effects" on health, safety or the environment.

Under US EPA regulations, 40 CFR §152.25(a), the seeds treated with pesticides are considered "treated articles" if, and only if:

a. the article contains or is treated with a pesticide;

b. the pesticide is intended to protect the article itself; and

c. the pesticide itself is registered for this use by US EPA.

Without this 'Treated Article Exemption' designation by US EPA for seed, there would be costly duplication of regulatory effort without any additional benefit to health, safety, or the environment, given US EPA's thorough review of the seed treatment product and its uses.

The Federal Seed Act regulates the labeling, sale, and movement of seed in the U.S., and seed companies must abide by its provisions. The tag on a package of treated seed must include identification of what the seed has been treated with, guidance for safe handling, and other applicable labeling requirements.

Appendix B. Summary of Laboratory Results for Lagoon Water and Treated Water

1. Summary of Detections in Lagoon and Treated Water
2. Lagoon Water Laboratory Summary Statistics
3. May 24, 2021, Treated Water Laboratory Summary Statistics
4. August 5, 2021, Treated Water Laboratory Summary Statistics (Total)
5. August 5, 2021, Treated Water Laboratory Summary Statistics (Dissolved)

Appendix C. Registered foliar or soil (non-seed treatment) uses of the focused analytes on crops commonly grown in Nebraska*

Focused analyte	Corn	Soybeans	Hay & Haylage	Wheat	Potatoes	Sorghum	Millet	Sunflower	Oats	Beans	Sugarbeets	Peas
Abamectin		✓			✓					✓		✓
Azoxystrobin	✓											
Chlorantraniliprole	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓		✓
Clothianidin		✓			✓							
Fluoxastrobin	✓	✓		✓	✓	✓						
Glyphosate**	✓	✓	✓	✓					✓		✓	
Imidacloprid										✓	✓	✓
Mefenoxam		✓	✓		✓					✓	✓	✓
Prothioconazole	✓	✓		✓								✓
Sedaxane												
Tebuconazole	✓			✓								
Thiabendazole												
Thiamethoxam					✓							

*From https://www.nass.usda.gov/Quick_Stats/Ag_Overview/stateOverview.php?state=NEBRASKA

**Glyphosate, as a pre-plant or post-harvest herbicide, has registrations for uses with nearly all crops

Appendix D. Lookup table for allowable pesticide active ingredient concentrations per application of each acre-inch of water (102,736 liters)

Pesticide	Proposed threshold for single application (grams/acre)*	Corresponding concentration in water (µg/L, parts per billion in one acre-inch)**
Abamectin CAS number 71751-41-2	1.1	10.7
Azoxystrobin CAS number 131860-33-8	11.30	110.0
Chlorantraniliprole CAS number 500008-45-7	4.45	43.3
Clothianidin CAS number 210880-92-5	3.0	29.2
Fluoxastrobin CAS number 361377-29-9	8.17	79.5
Imidacloprid CAS number 138261-41-3	6.7	65.2
Glyphosate CAS number 1071-83-6	62.43	607.7
Metalaxyl/Mefenoxam CAS numbers 57837-19-1 and 70630-17-0	14.2	138.2
Prothioconazole CAS number 178928-70-6	1.86	18.1
Sedaxane CAS number 874967-67-6	0.51	5.0

Pesticide	Proposed threshold for single application (grams/acre)*	Corresponding concentration in water (µg/L, parts per billion in one acre-inch)**
Tebuconazole CAS number 107534-96-3	4.64	45.2
Thiabendazole CAS number 148-79-8	0.26	2.5
Thiamethoxam CAS number 153719-23-4	2.5	24.3

*From Table 1

**To determine the target volume of treated water for an individual application, use the equation:
Allowable volume (acre-inch) = ((Threshold value in g/ac × 1,000,000 µg/g) / (analyte concentration in ppb or µg/L) / 102,736 L/acre.

Appendix E. Standard Operating Procedures

1. Equipment Decontamination
2. Soil Sampling, Agronomic Parameters
3. Soil Sampling, Pesticides
4. Treated Water Sampling

Appendix F. US EPA approved tolerances for focused analytes on corn grain from 40 CFR 180

Focused analyte	Tolerance in corn (parts per million, ppm)
Abamectin	0.4
Azoxystrobin	0.05
Chlorantraniliprole	0.04
Clothianidin	0.01
Fluoxastrobin	0.02
Glyphosate*	5.0
Imidacloprid	0.05
Mefenoxam**	0.1
Prothioconazole	0.35
Sedaxane	0.01
Tebuconazole	0.05
Thiabendazole	0.01
Thiamethoxam	0.02

*Tolerance accounts for the metabolite, AMPA

**As metalaxyl